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(54) **MOTOR WITH ROTOR HOLDER HAVING FIRST AND SECOND MAGNETS WITH DIFFERENT INTERVALS TO HOLDER**

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(Continued)

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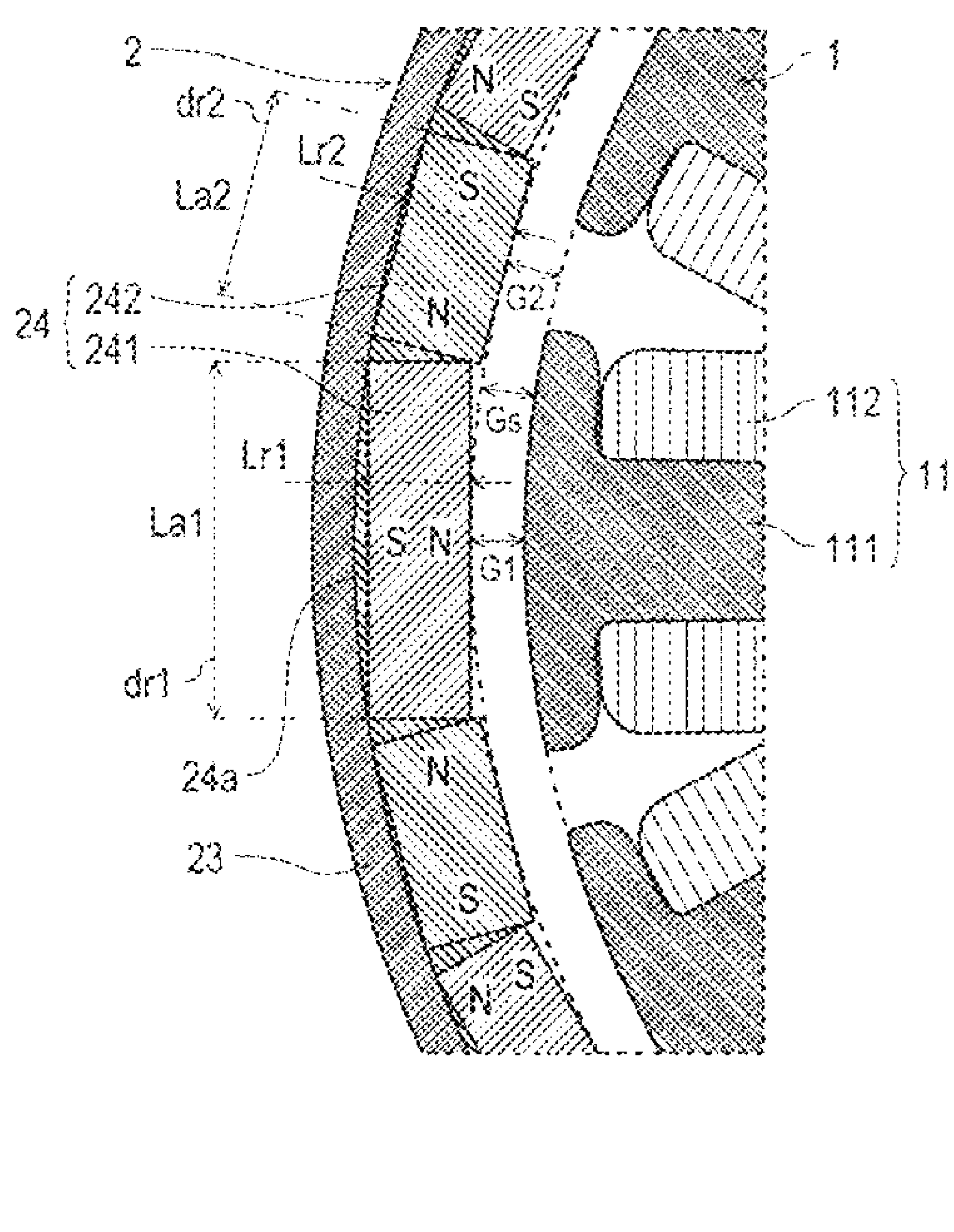
(57) **ABSTRACT**

A motor includes a stationary unit including a stator and a rotation unit including a magnet unit disposed radially outward of the stator and a cylindrical rotor holder. The magnet unit is held on a radially inside surface of the rotor holder. The magnet unit includes first magnets each of which has N and S poles magnetized in a radial direction, and second magnets each of which has N and S poles magnetized in a circumferential direction. Magnetic poles of radially inner end portions of the first magnets adjacent to each other in the circumferential direction via the second magnet are different from each other. Magnetic poles of circumferential end portions of the second magnets adjacent to each other in the circumferential direction via the first magnet are different from each other. An interval is provided between a radially outside surface of each first magnet and the radially inside surface of the rotor holder, and between a radially outside surface of each second magnet and the radially inside surface of the rotor holder.

6 Claims, 4 Drawing Sheets



(51) **Int. Cl.**
H02K 21/22 (2006.01)
H02K 1/14 (2006.01)

(58) **Field of Classification Search**
USPC 310/156.08–156.15, 156.28, 156.29, 310/156.38, 156.43, 156.45, 154.13
See application file for complete search history.

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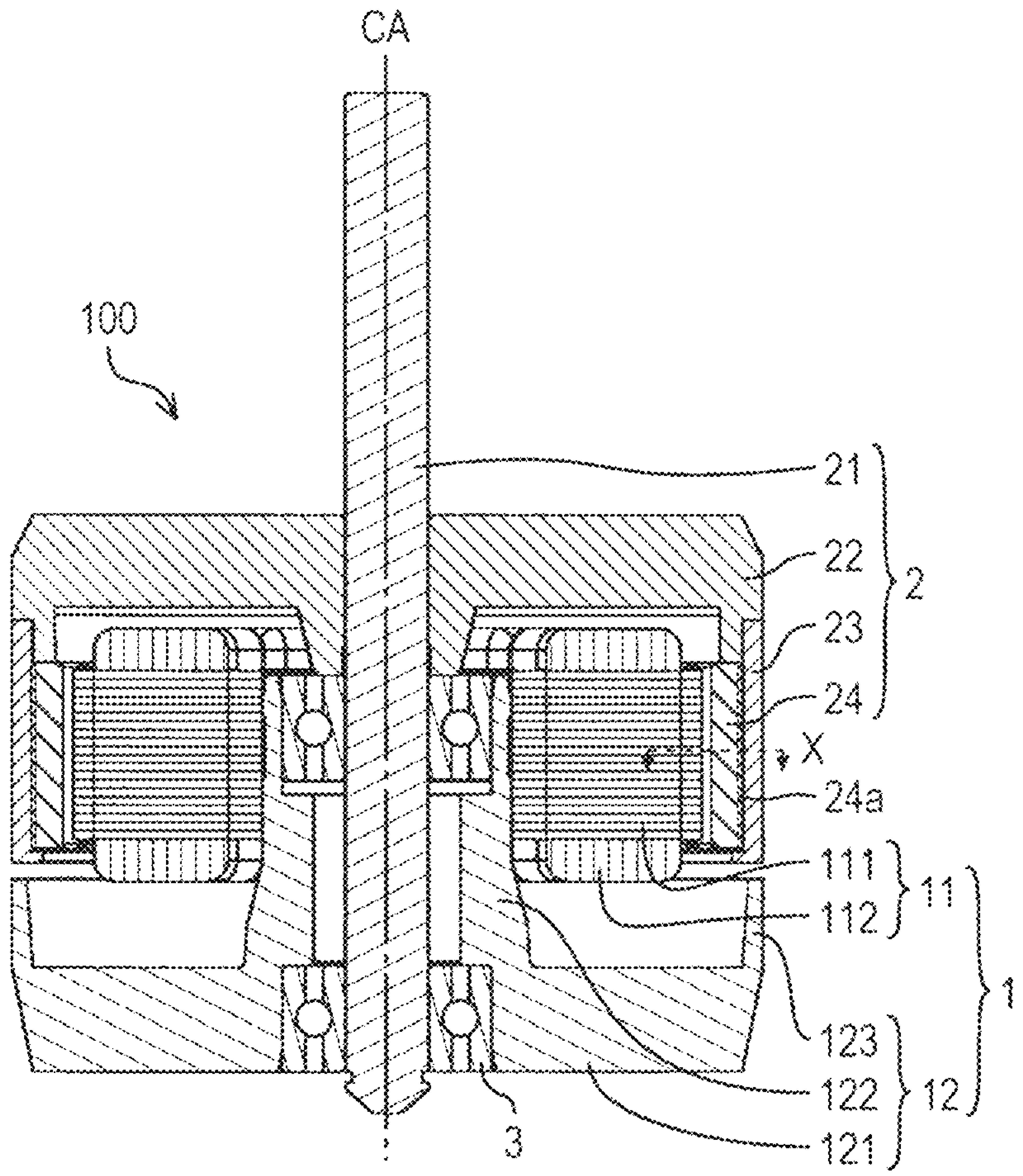


Fig. 1

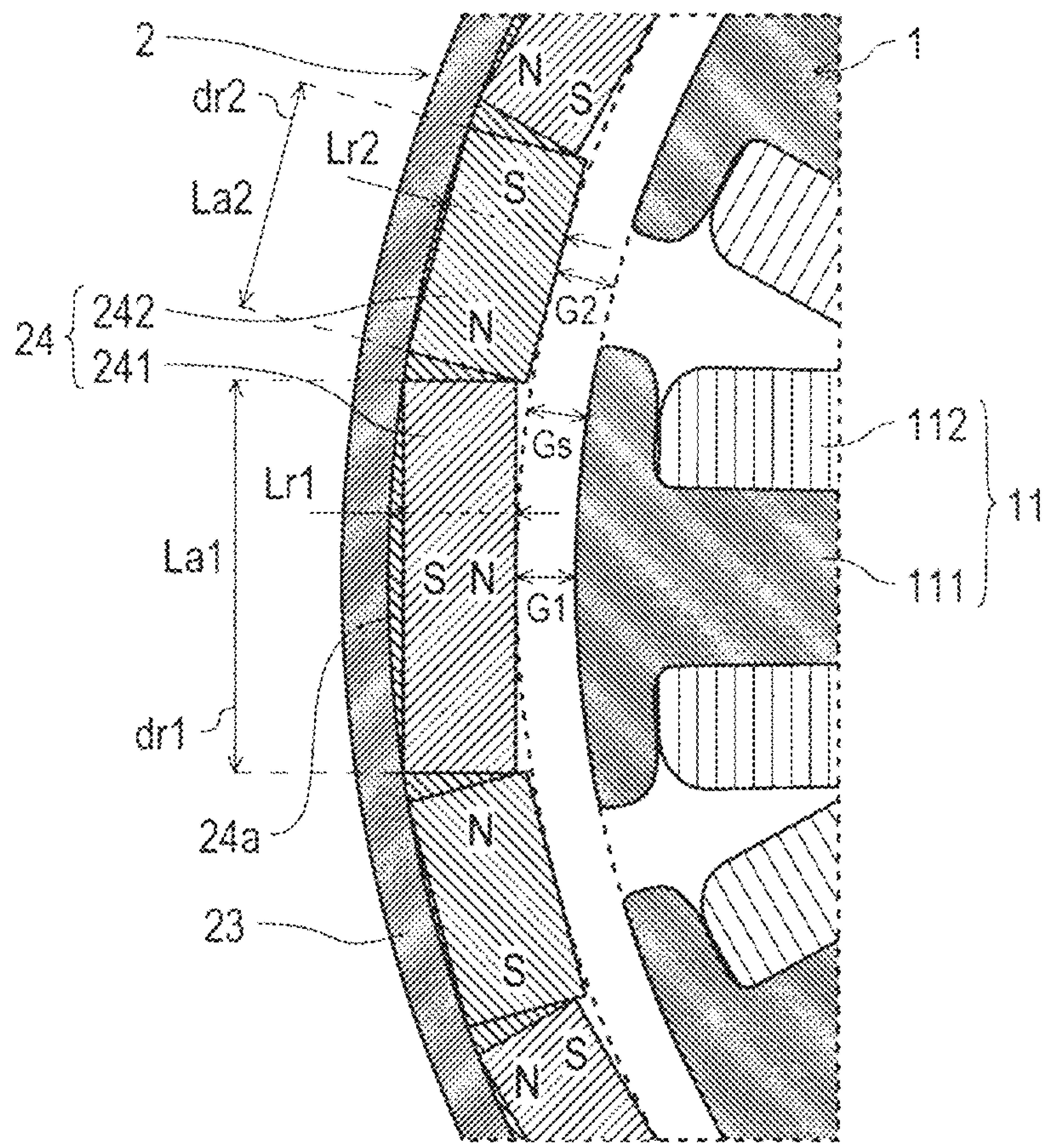
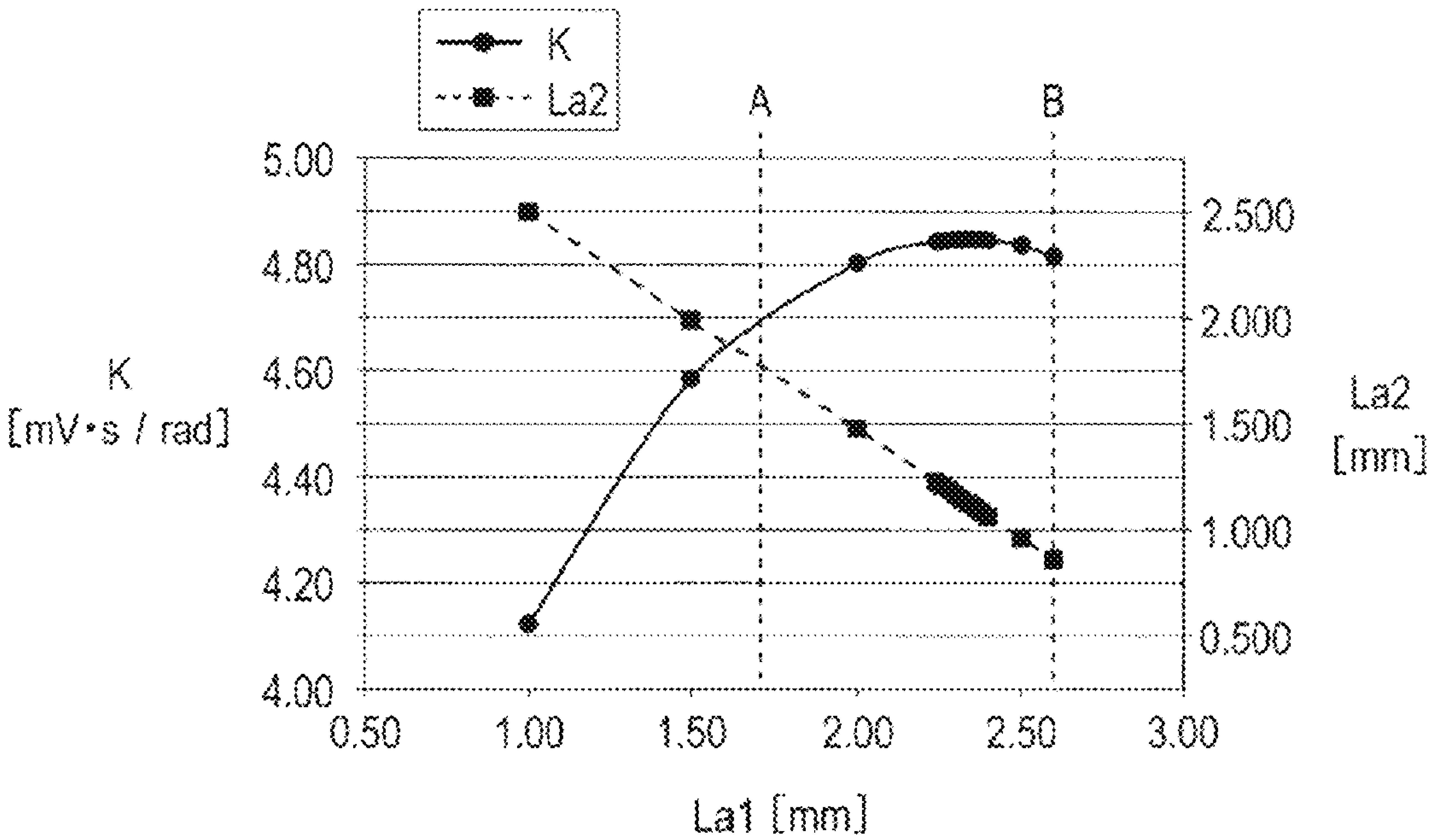


Fig. 2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1.500
1.000
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[mm]
0.50
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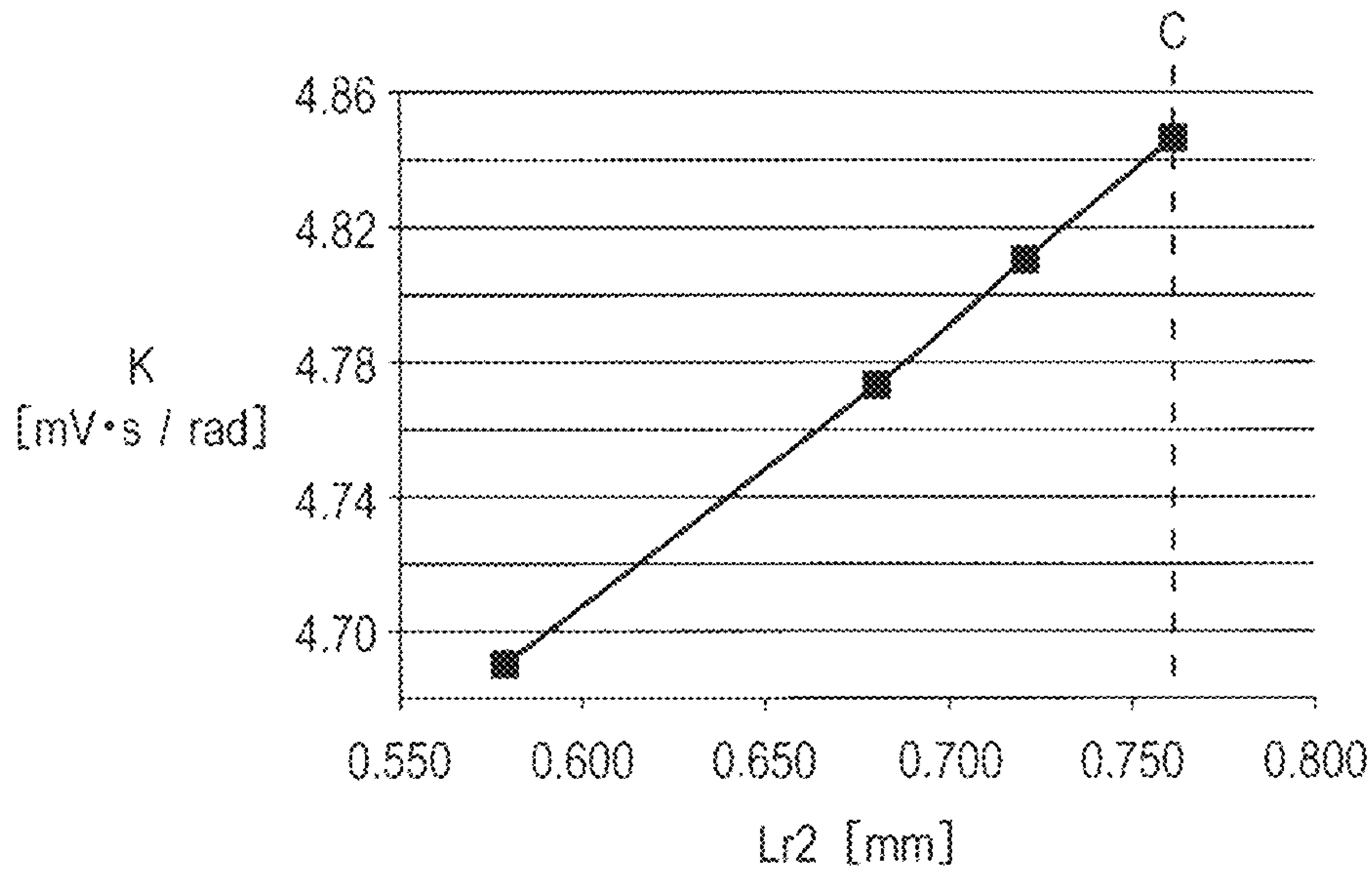
2.00
2.50
3.00
La1 [mm]

Fig. 3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K
[mV·s / rad]
0.550
0.600
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0.700
0.750
0.800
Lr2 [mm]

Fig. 4

MOTOR WITH ROTOR HOLDER HAVING FIRST AND SECOND MAGNETS WITH DIFFERENT INTERVALS TO HOLDER

CROSS REFERENCE TO RELATED APPLICATION

The present invention claims priority under 35 U.S.C. § 119 to Japanese Application No. 2018-183576 filed on Sep. 28, 2018, the entire contents of which are hereby incorporated herein by reference.

1. FIELD OF THE INVENTION

The present disclosure relates to a motor.

2. BACKGROUND

An outer rotor type motor in which a magnet unit is disposed on a radial outward of a stator has been conventionally known. The structure of an outer peripheral surface of each permanent magnet is provided on the inner circumferential surface of the cylindrical member. Thus, a shape of each permanent magnet is processed into a shape along the inner circumferential surface of the cylindrical member. Consequently, processing of the permanent magnet becomes difficult, and a cost required for processing also increases.

SUMMARY

Example embodiments of the present disclosure provide motors that each facilitate manufacture of a magnet used for a magnet unit.

A motor according to an example embodiment of the present disclosure includes a stationary unit including a stator annularly surrounding a vertically extending central axis, and a rotation unit including a magnet unit disposed on a radial outward of the stator. The rotation unit further includes a cylindrical rotor holder extending in an axial direction. The magnet unit is held on a radially inside surface of the rotor holder. The magnet unit includes a plurality of first magnets each of which has N and S poles magnetized in a radial direction, and a plurality of second magnets each of which has N and S poles magnetized in a circumferential direction. Each first magnet and each second magnet are adjacent to each other in the circumferential direction. Magnetic poles of radially inner end portions of the first magnets adjacent to each other in the circumferential direction via the second magnet are different from each other. Magnetic poles of circumferential end portions of the second magnets adjacent to each other in the circumferential direction via the first magnet are different from each other. An interval is provided between a radially outside surface of the first magnet and the radially inside surface of the rotor holder, and an interval is provided between a radially outside surface of the second magnet and the radially inside surface of the rotor holder.

The above and other elements, features, steps, characteristics and advantages of the present disclosure will become more apparent from the following detailed description of the example embodiments with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a sectional view illustrating a configuration example of a motor of an example embodiment of the present disclosure.

FIG. **2** is a sectional view of a motor illustrating a configuration example of a magnet unit of an example embodiment of the present disclosure.

FIG. **3** is a graph illustrating a change in a back electromotive force constant and a change in a circumferential length of a second magnet with respect to a change in a circumferential length of a first magnet.

FIG. **4** is a graph illustrating the change in the back electromotive force constant with respect to a change in a radial length of the second magnet.

DETAILED DESCRIPTION

Hereinafter, example embodiments of the present disclosure will be described with reference to the drawings.

In the present specification, in a motor **100**, a direction parallel to a central axis CA is referred to as "axial direction". Among the axial directions, a direction from a bracket **12** described later to a shaft holder **22** is referred to as "upper", and a direction from the shaft holder **22** to the bracket **12** is referred to as "lower".

An orthogonal direction to the central axis CA is referred to as "radial direction". Among the radial directions, a direction approaching the central axis CA is referred to as "radial inward", and a direction away from the central axis CA is referred to as "radial outward".

A rotation direction around the central axis CA is referred to as "circumferential direction".

The directions described above are not intended to limit directions in a case of incorporation into an actual apparatus.

FIG. **1** is a sectional view illustrating a configuration example of the motor **100**. FIG. **1** illustrates a sectional structure of the motor **100** when the motor **100** is cut along a virtual plane including the central axis CA.

As shown in FIG. **1**, the motor **100** includes a stationary unit **1** and a rotation unit **2**. The stationary unit **1** has a stator **11** described later annularly surrounding the central axis CA extending in a vertical direction. The rotation unit **2** has a magnet unit **24** described later disposed on a radial outward of the stator **11**. The motor **100** further includes bearings **3**.

The stationary unit **1** includes the above-described stator **11** and the bracket **12**.

The stator **11** drives the rotation unit **2** around the central axis CA. More specifically, the stator **11** drives the rotation unit **2** to rotate in the circumferential direction. The stator **11** is supported by a bearing holder **122** described later of the bracket **12**.

The stator **11** has a stator core **111**, insulators (not shown), and a plurality of coil units **112**. The stator core **111** is an annular magnetic body centered on the central axis CA, and in the present example embodiment, it is a layered body in which a plurality of plate-like electromagnetic steel sheets are layered. The stator core **111** is fixed to the bearing holder **122**. In the present example embodiment, a radially inner end portion of the stator core **111** is fixed to a radially outside surface of the bearing holder **122**. A radially outside surface of the stator core **111** is radially opposite to the magnet unit **24**. Each of the plurality of coil units **112** is a winding member in which a conductor wire is wound around the stator core **111** via the insulator having electrical insulation.

The bracket **12** has a lower lid part **121**, the bearing holder **122**, and an outer wall part **123**.

The lower lid part **121** has an annular shape centered on the central axis CA and a plate shape spreading in the radial direction. The bearing holder **122** is provided at a radially inner end portion of the lower lid part **121**. The outer wall part **123** is provided at a radially outer end portion of the lower lid part **121**.

The bearing holder **122** has a cylindrical shape extending in the axial direction centered on the central axis CA. The bearing holder **122** projects upward from the radially inner end portion of the lower lid part **121**. The bearing holder **122** supports the stator **11**. A radially inner end portion of the stator **11** is fixed to the bearing holder **122**. Inside the bearing holder **122**, the bearings **3** are provided. In the present example embodiment, the bearings **3** are respectively provided on an axial upper portion and an axial lower portion of the motor **100**. A shaft **21** described later is inserted into the bearing holder **122** and the bearings **3**. The bearing holder **122** rotatably supports the shaft **21** via the bearings **3**. Although each of the bearings **3** is a ball bearing in this example embodiment, it is not limited to this exemplification, for example, a sleeve bearing may be permissible.

In the present example embodiment, the outer wall part **123** is cylindrical around the central axis CA, and extends in the axial direction. The outer wall part **123** protrudes upward from the radially outer end portion of the lower lid part **121**.

The rotation unit **2** will be described hereinbelow. The rotation unit **2** includes the shaft **21**, the shaft holder **22**, a rotor holder **23**, and the above-described magnet unit **24**.

The shaft **21** is a rotation axis of the rotation unit **2**. The shaft **21** is rotatable around the central axis CA together with the shaft holder **22**, the rotor holder **23**, and the magnet unit **24**. The shaft **21** is not limited to this exemplification, and may be a fixed shaft attached to the stationary unit **1**. When the shaft **21** is the fixed shaft, the bearing is provided between the shaft **21** and the shaft holder **22**.

The shaft holder **22** is attached to the shaft **21** at the axial upper portion of the motor **100**. In the present example embodiment, the shaft holder **22** is fixed to the shaft **21** and spreads to the radial outward from a radially outside surface of the shaft **21**.

The rotor holder **23** has a tubular shape extending in the axial direction. As described above, the rotation unit **2** has the rotor holder **23**. The magnet unit **24** is held on a radially inside surface of the rotor holder **23**. The rotor holder **23** is provided at a radially outer end portion of the shaft holder **22** and extends downward from the radially outer end portion. An upper end portion of the rotor holder **23** is covered with the shaft holder **22**.

FIG. **2** is a sectional view of the motor **100** illustrating a configuration example of the magnet unit **24**. FIG. **2** is a partial cross section of the motor **100** as viewed from above at a broken line X in FIG. **1**. In FIG. **2**, an illustration of the insulator is omitted. In FIG. **2**, a symbol N represents an N pole of the magnet. A symbol S represents an S pole of the magnet.

The magnet unit **24** is radially opposite to a radially outside surface of the stator **11**. As shown in FIG. **2**, the magnet unit **24** includes a plurality of first magnets **241** and a plurality of second magnets **242**. In each of the first magnets **241**, the N pole and the S pole are magnetized in the radial direction. In each of the second magnets **242**, the N pole and the S pole are magnetized in the circumferential direction.

The first magnets **241** and the second magnets **242** are arranged in the circumferential direction in a Halbach array. More specifically, each first magnet **241** and each second magnet **242** are arranged adjacent to each other in the circumferential direction. Magnetic poles of radially inner end portions of the first magnets **241** adjacent to each other in the circumferential direction via the second magnet **242** are different from each other. Magnetic poles of one circumferential end portions of the second magnets **242** adjacent to each other in the circumferential direction via the first magnet **241** are different from each other. By arranging the first magnets **241** and the second magnets **242** in the Halbach array, a magnetic field of a radial inward of the first magnets **241** and the second magnets **242** becomes stronger. On the other hand, a magnetic field of a radial outward of the first magnets **241** and the second magnets **242** becomes weaker. Since the magnetic field on a side of the rotor holder **23** is weakened, magnetic saturation in the rotor holder **23** is suppressed. Thus, a thickness in the radial direction of the rotor holder **23** becomes thinner.

The first magnets **241** and the second magnets **242** are provided on the radially inside surface of the rotor holder **23**. In the present example embodiment, both circumferential end portions at a radially outer end of each first magnet **241** and both circumferential end portions at a radially outer end of each second magnet **242** are in contact with the radially inside surface of the rotor holder **23**. Intervals are provided between a radially outside surface of each first magnet **241** and the radially inside surface of the rotor holder **23** and between a radially outside surface of each second magnet **242** and the radially inside surface of the rotor holder **23**, respectively. The interval between the radially outside surface of each first magnet **241** and the radially inside surface of the rotor holder **23** is a space surrounded by the radially outside surface of the first magnet **241** and the radially inside surface of the rotor holder **23**. The interval between the radially outside surface of each second magnet **242** and the radially inside surface of the rotor holder **23** is a space surrounded by the radially outside surface of the second magnet **242** and the radially inside surface of the rotor holder **23**.

In this case, the radially outside surface of each first magnet **241** and the radially outside surface of each second magnet **242** need not be formed to conform to the radially inside surface of the rotor holder **23**. Thus, manufacture of the magnets **241**, **242** used for the magnet unit **24** is facilitated.

For example, as described later, adhesive **24*a*** or the like is fillable between the radially outside surface of each first magnet **241** and the radially outside surface of each second magnet **242** and the radially inside surface of the rotor holder **23**. In particular, even in a case where the adhesive **24*a*** includes particles each having a relatively large diameter of, for example, about 30 μm as a curing agent, the adhesive **24*a*** is fillable between the radially outside surface of the first magnet **241** and the radially outside surface of the second magnet **242** and the radially inside surface of the rotor holder **23**.

In the present example embodiment, each of the radially outside surface of the first magnet **241** and the radially outside surface of the second magnet **242** is a plane perpendicular to the radial direction. Shapes of each first magnet **241** and each second magnet **242** are rectangular parallelepipeds respectively. In this case, the first magnet **241** and the second magnet **242** are formed in the simple shapes. Thus, the manufacture of the first magnet **241** and the second magnet **242** is further facilitated. The shapes of the first magnet **241** and the second magnet **242** are not limited to these exemplifications, and the first magnet **241** and the second magnet **242** may have any shapes as long as gaps are provided between their radially outside surfaces and the radially inside surface of the rotor holder **23** respectively. For example, at least one of the radially outside surface of each first magnet **241** and the radially outside surface of each second magnet **242** may be a curved surface. In addition, the shape of at least one of the first magnet **241** and the second magnet **242** may not be the rectangular parallelepiped.

In this example embodiment, between the radially outside surface of each first magnet **241** and the radially inside surface of the rotor holder **23** and between the radially outside surface of each second magnet **242** and the radially inside surface of the rotor holder **23**, the adhesive **24***a* is provided. Thus, the first magnets **241** and the second magnets **242** are more firmly fixed to the radially inside surface of the rotor holder **23** by the adhesive **24***a*.

The present disclosure is not limited to this exemplification, and the adhesive **24***a* may be provided either between the radially outside surface of each first magnet **241** and the radially inside surface of the rotor holder **23** or between the radially outside surface of each second magnet **242** and the radially inside surface of the rotor holder **23**. That is, at least one of at least a portion of the radially outside surface of each of the first magnets **241** and at least a portion of the radially outside surface of each of the second magnets **242** is opposite to the radially inside surface of the rotor holder **23** via the adhesive **24***a*. In this case, at least one of each first magnet **241** and each second magnet **242** is attached to the radially inside surface of the rotor holder **23** more firmly by the adhesive **24***a*.

In the present example embodiment, an interval is provided between one circumferential side surface of the first magnet **241** and the other circumferential side surface of the second magnet **242** circumferentially adjacent to the first magnet **241**. The interval is a space surrounded by the one circumferential side surface of the first magnet **241**, the other circumferential side surface of the second magnet **242** circumferentially adjacent to the first magnet **241**, and the radially inside surface of the rotor holder **23**. The adhesive **24***a* is provided in the interval. By doing so, the first magnet **241** and the second magnet **242** circumferentially adjacent are fixed to each other. The present disclosure is not limited to this exemplification. No gap may be provided between both of them, and the adhesive **24***a* may not be provided between them. For example, the entire one circumferential side surface of one of the first magnet **241** and the second magnet **242** circumferentially adjacent to the first magnet **241** may be in contact with the other circumferential side surface of the other of the first magnet **241** and the second magnet **242**. In the present example embodiment, the one circumferential side surface of the first magnet **241** is the surface facing the second magnet **242** circumferentially adjacent. The other circumferential side surface of the second magnet **242** is the surface facing the first magnet **241** circumferentially adjacent.

The adhesive **24***a* is not limited to the above-described exemplification, and may be provided between the one circumferential side surface of each first magnet **241** and the other circumferential side surface of each second magnet **242** circumferentially adjacent to the first magnet **241** instead of providing between the radially outside surface of each first magnet **241** and the radially outside surface of each second magnet **242** and the radially inside surface of the rotor holder **23**.

In order to prevent the magnet unit **24** from coming into contact with the stator **11** when the rotation unit **2** rotates, each of a gap G**1** in the radial direction between each first magnet **241** and the stator **11** and a gap G**2** in the radial direction between each second magnet **242** and the stator **11** is set to a constant value Gs (for example, 0.22 mm) or more. The gap G**1** and the gap G**2** are preferably set to smaller values. By doing so, the stator **11** rotates the rotation unit **2** more efficiently.

Thus, in the present example embodiment, the gap G**2** in the radial direction between the second magnet **242** and the stator **11** is the same as the gap G**1** in the radial direction between the first magnet **241** and the stator **11**. For example, each of the gap G**1** and the gap G**2** is the same as the constant value Gs. By doing so, both each of the first magnets **241** and each of the second magnets **242** are brought closer to the stator **11**. Thus, magnetic forces exerted by each first magnet **241** and each second magnet **242** on the stator **11** become stronger.

As described above, in the present example embodiment, each first magnet **241** and each second magnet **242** are rectangular parallelepipeds. In the present example embodiment, a distance between the one circumferential side surface and the other circumferential side surface of each first magnet **241** is referred to as a circumferential length La**1**. A distance between the one circumferential side surface and the other circumferential side surface of each second magnet **242** is referred to as a circumferential length La**2**. A distance between a radially inside surface and the radially outside surface of each first magnet **241** is referred to as a radial length Lr**1**. A distance between a radially inside surface and the radially outside surface of each second magnet **242** is referred to as a radial length Lr**2**.

More strictly, the circumferential length La**1** is a length of the radially inner end portion of the first magnet **241** in a direction dr**1** that is perpendicular to the axial direction and parallel to the radially inside surface of the first magnet **241**. The circumferential length La**2** is a length of a radially inner end portion of the second magnet **242** in a direction dr**2** that is perpendicular to the axial direction and parallel to the radially inside surface of the second magnet **242**. The radial length Lr**1** is a length of the first magnet **241** in the radial direction passing through a point closest to the stator **11** at the radially inner end portion of the first magnet **241**. The radial length Lr**2** is a length of the second magnet **242** in the radial direction passing through a point closest to the stator **11** at the radial inner end portion of the second magnet **242**.

The first magnets **241** and the second magnets **242** are densely arranged in the circumferential direction. Thus, in the present example embodiment, the circumferential end portion at the radially inner end portion of one of the first magnet **241** and the second magnet **242** is closed to a circumferential side surface of the other of the first magnet **241** and the second magnet **242**. For example, in a case in which the circumferential length La**1** of each first magnet **241** is longer than the circumferential length La**2** of each second magnet **242**, when both the first magnets **241** and the second magnets **242** are brought closer to the stator **11**, the radial length Lr**2** of each second magnet **242** is longer than the radial length Lr**1** of each first magnet **241**. In that case, as shown in FIG. **2**, the circumferential end portion at the radially inner end portion of the first magnet **241** is in contact with the circumferential side surface of the second magnet **242**. When La**1**<La**2** is satisfied and Lr**1**>Lr**2** is satisfied, the circumferential end portion at the radially inner end portion of the second magnet **242** is closed to the circumferential side surface of the first magnet **241**. When La**1**=La**2** is satisfied and Lr**1**=Lr**2** is satisfied, the circumferential end portion at the radially inner end portion of the first magnet **241** is closed to the circumferential end portion at the radially inner end portion of the second magnet **242**.

The circumferential length La**1** of each first magnet **241** is preferably longer than the circumferential length La**2** of each second magnet **242**.

The smaller the gap G**1** and the gap G**2** between each first magnet **241** and each second magnet **242** and the stator **11** respectively are, the stronger the magnetic forces exerted on the stator **11** by each first magnet **241** and each second magnet **242** respectively becomes. For example, in a case in which a circumferential length of the radially inside surface of the rotor holder **23** is constant and the first magnets **241** and the second magnets **242** are densely arranged in the circumferential direction as shown in FIG. **2**, when the circumferential length La**1** of each first magnet **241** becomes longer, the circumferential length La**2** of each second magnet **242** becomes shorter. When the gap G**1** and the gap G**2** have the constant value Gs (for example, 0.22 mm) and the circumferential length of the radially inside surface of the rotor holder **23** is constant, the longer the circumferential length La**1** of each first magnet **241** is made, as shown in FIG. **3**, the larger a back electromotive force constant K of the motor **100** becomes. Furthermore, when La**1**>La**2** is satisfied beyond a condition A in FIG. **3**, the back electromotive force constant K of the motor **100** is made sufficiently large (for example, 4.7 mV·s/rad or more).

The back electromotive force constant K is a constant that indicates efficiency of converting power into rotational energy of the motor **100**. As the back electromotive force constant K is larger, the motor **100** generates a larger output.

In FIG. **3**, under a condition B, the circumferential length La**1** of each first magnet **241** is three times the circumferential length La**2** of each second magnet **242**. In the present example embodiment, in a region where La**1**>(3×La**2**) is satisfied on a right side of the condition B, the circumferential length La**2** of each second magnet **242** becomes thin, and actually exceeds a processing limit. Thus, in FIG. **3**, plotting up to the condition B in which the circumferential length La**1** is three times the circumferential length La**2** is performed.

In addition, when La**1**>La**2** is satisfied, the radial length Lr**2** of each second magnet **242** is preferably longer than the radial length Lr**1** of each first magnet **241**.

As the circumferential length La**1** of each first magnet **241** becomes longer, the interval between the radially outside surface of each first magnet **241** and the radially inside surface of the rotor holder **23** becomes wider. As the circumferential length La**2** of each second magnet **242** becomes shorter, the interval between the radially outside surface of each second magnet **242** and the radially inside surface of the rotor holder **23** becomes narrower. Thus, for example, in a case in which the circumferential length of the radially inside surface of the rotor holder **23** is constant, the first magnets **241** and the second magnets **242** are densely arranged in the circumferential direction as shown in FIG. **2**, and the circumferential length La**1** of each first magnet **241** becomes longer than the circumferential length La**2** of each second magnet **242**, when the radial length Lr**2** of each second magnet **242** is the same as the radial length Lr**1** of each first magnet **241**, each second magnet **242** is farther from the stator **11** than each first magnet **241**. In the case described above, the gap G**2** between each second magnet **242** and the stator **11** is larger than the gap G**1** between each first magnet **241** and the stator **11**. On the other hand, when a dimension of each first magnet **241** is constant in the above case, the back electromotive force constant K of the motor **100** becomes higher as the radial length Lr**2** of each second magnet **242** is larger as shown in FIG. **4**. As the gap G**2** between each second magnet **242** and the stator **11** is narrower, the magnetic force exerted on the stator **11** by each second magnet **242** becomes stronger. In FIG. **4**, the back electromotive force constant K of the motor **100** is maximized under a condition C where the gap G**2** becomes the above-described constant value Gs that is the smallest. Thus, by making the radial length Lr**2** of each second magnet **242** longer than the radial length Lr**1** of each first magnet **241**, each second magnet **242** is made closer to the stator **11**, and the back electromotive force constant K of the motor **100** is made larger.

The example embodiment of the present disclosure has been described above. The scope of the present disclosure is not limited to the example embodiment described above. The present disclosure is executable by adding various changes to the above-described example embodiment without departing from the scope of the disclosure. The matters described in the above example embodiment are appropriately and arbitrarily combined as long as no inconsistency occurs.

The present disclosure is useful for the motor in which the magnet unit including the plurality of magnets is provided on the radially inside surface of the rotor holder.

While example embodiments of the present disclosure have been described above, it is to be understood that variations and modifications will be apparent to those skilled in the art without departing from the scope and spirit of the present disclosure. The scope of the present disclosure, therefore, is to be determined solely by the following claims.

What is claimed is:

1. A motor comprising:

a stationary unit including a stator annularly surrounding a vertically extending central axis; and

a rotation unit including a magnet unit disposed radially outward surface of the stator;

wherein the rotation unit further includes a cylindrical rotor holder extending in an axial direction;

the magnet unit is held on a radially inside surface of the rotor holder;

the magnet unit includes a plurality of first magnets each of which has N and S poles magnetized in a radial direction, and a plurality of second magnets each of which has N and S poles magnetized in a circumferential direction;

each first magnet and each second magnet are adjacent to each other in the circumferential direction;

magnetic poles of radially inner end portions of the first magnets adjacent to each other in the circumferential direction via the second magnet are different from each other;

magnetic poles of circumferential end portions of the second magnets adjacent to each other in the circumferential direction via the first magnet are different from each other;

a first interval is provided between a radially outside surface of each first magnet and the radially inside surface of the rotor holder, and a second interval is provided between a radially outside surface of each second magnet and the radially inside surface of the rotor holder;

when viewed in the axial direction, there is a closed space between side surfaces of the first magnets in the circumferential direction and side surfaces of the second magnets in the circumferential direction which is adjacent to the first magnets in the circumferential direction;

the closed space is bounded by the side surfaces of the first magnets, the side surfaces of the second magnets, and the radially inside surface of the rotor holder; and

an adhesive fins the closed space.

2. The motor according to claim **1**, wherein shapes of each first magnet and each second magnet are rectangular parallelepipeds.

3. The motor according to claim **1**, wherein at least one of at least a portion of the radially outside surface of each first magnet and at least a portion of the radially outside surface of each second magnet is opposite to the radially inside surface of the rotor holder via adhesive.

4. The motor according to claim **1**, wherein a radial gap between each second magnet and the stator is identical to a radial gap between each first magnet and the stator.

5. The motor according to claim **1**, wherein a circumferential length of each first magnet is longer than a circumferential length of each second magnet.

6. The motor according to claim **5**, wherein a radial length of each second magnet is longer than a radial length of each first magnet.

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